Resource Action: EWG-88 **Task Force Recommendation Category:** 2

Increase Flows in the Low-Flow Reach of the Feather River to Increase Spawning Habitat for Anadromous Salmonids

Date of Field Evaluation: No field evaluation was conducted

Evaluation Team: Richard Harris, Brad Cavallo, and Koll Buer

Description of Potential Resource Action Measure:
This measure would increase the minimum flows (base flow) to the low flow reach (currently 600 cfs) during peak spawning periods for Chinook salmon and steelhead. The intention is to increase the area of habitat available for salmon and steelhead spawning. Flows would be maintained at sufficient levels to avoid dewatering redds.

Other Resource Actions that are either similar to or otherwise related to this measure include:

- EWG-13A/20 and EWG-13B, that propose to improve rearing habitat through placement of wood and other materials in the low flow reach and lower Feather River.
- EWG-15A and EWG-15B, that propose to incrementally increase flows (ramping flows) in the low flow reach throughout the Chinook salmon spawning season.
- EWG-16A and EWG-16B, that propose to create or enhance side channel habitat in the low flow reach.
- EWG-18, that would involve raking or ripping spawning areas to improve substrate suitability for spawning.
- EWG-92, that would supplement gravel supplies in the low flow reach to increase suitability of substrate for spawning.
- EWG-100, that proposes to simulate the historic flow regime through periodic flow increases in the lower Feather River to encourage outmigration of salmonids.

Nexus to the Project:
Many factors, including flood control levees, construction of the dam at Lake Oroville, historic land use activities (hydraulic mining), and regulation of stream flows have caused changes to the geomorphology and substrate in the Feather River system. The cumulative impacts of these changes have generally reduced the availability (quantity and quality) of spawning and rearing habitat for anadromous fishes. Since the Oroville Facilities Project was constructed, the low flow reach of the Feather River has generally been considered the most important section of the river for spawning and rearing. Because of reduced habitat quality and quantity, the productivity of the Feather River anadromous salmonid fishery has been reduced.

Potential Environmental Benefits:
The potential benefit of the proposed Resource Action would be an increase in the available spawning habitat for steelhead and Chinook salmon, specifically Central Valley spring-run Chinook salmon, a threatened species under the California Endangered Species Act (September 22, 1989). If this measure and others aimed at improving habitat are successful, there should eventually be improved fish production from the Feather River.

Potential Constraints:
The main constraint to this measure is availability of water. Increasing streamflow in the low flow reach would likely be at the expense of hydropower generation and possible water supply. Other constraints pertain to the current channel conditions (cover, quantity and quality of spawning gravel, channel morphology, etc.) and the uncertainty that simply increasing flows alone would provide any increases in suitable spawning habitat.

Existing Conditions in the Proposed Resource Action Implementation Area:
Flows in the low flow reach are maintained at 600 cfs except when the occasional extreme inflow to the lake requires massive releases. It is generally understood that availability of spawning and rearing habitat are limiting factors for production of anadromous salmonids in the Feather River below Oroville Dam. Information from Study Plan Report, SP G2, which is currently in preparation, indicates that spawning habitat in the low flow reach is not only limited in area, but also degraded in quality. That is, sediment trapping behind Oroville Dam has contributed to a coarsening of substrate to the extent that many spawning areas do not have suitably sized substrate. It is also believed that the releases (streamflows) to the low flow reach may also be limiting spawning.

The instream habitats in the low flow reach reflect the lack of sediment inputs, effects of regulated flows, and confinement by levees. Habitat diversity in the low flow reach is generally low (DWR, 1994). Preliminary data available from SP G2 indicates that pools (>5 feet deep and slow velocity) comprise 69 percent of the reach between the Fish Barrier Dam and Thermalito (low flow reach). Glides and runs are about 16 percent, and riffles are about six percent. Backwater areas, which may be favorable for rearing habitat, are about nine percent of the low flow reach.

Design Considerations and Evaluation:
Increasing minimum flows would seem to be a simple solution to increasing the availability of spawning habitat in the low flow reach. There are however, several considerations that make the decision complex.

An instream flow study was conducted to help define the range of flows that may provide the most benefits to anadromous fish spawning and rearing (Study Plan Report, SP F16). Preliminary information on the Weighted Usable Area (WUA) developed from the Physical Habitat Simulation Model (PHABSIM) indicates that Chinook spawning

habitat between the Fish Barrier Dam and Thermalito Afterbay Outlet (low flow reach) is maximized at a flow regime between 700 and 725 cfs, which is somewhat greater than the current flow prescription of 600 cfs (Figure 1). However, over a range from 600 to 900 cfs, there is little difference in the weighted usable spawning habitat.

Because the LFC is a remnant of the river channel prior to construction of the Oroville Facilities, the maximum weighted usable habitat might be expected to be similar to the WUA downstream of the Afterbay Outlet (high flow channel). Since the maximum WUA for spawning in the lower river (high flow channel) occurs at a flow of approximately 1,800 cfs, it is possible that the low flow reach has adjusted to the 600 cfs minimum flow, and that with a larger minimum flow, the LFC would readjust. This indicates that adjusting the current minimum flow may not be the best approach for maximizing spawning habitat in the LFC.

There are a number of other measures proposed to improve habitat (e.g., EWG-13A/30, EWG-13B, EWG-18, and EWG 92). Most, if not all of these, will depend on a complementary flow regime to be effective. The entire subject of flow management in relation to proposed habitat improvements should be addressed comprehensively with the assistance of available modeling tools (PHABSIM and Fluvial-12).

Another consideration is the potential effects of increased flows on existing spawning habitat. According to data forthcoming from SP G2, some riffles are currently at or near critical velocity thresholds (stability concerns). Therefore, increasing flows to the low flow reach could contribute to erosion and habitat degradation at these locations.

Synergisms and Conflicts:
This Resource Action should be a significant component of an overall strategy aimed at improving the production of anadromous salmonids in the Feather River. It could be compatible with, and synergistic with, other measures to improve spawning and rearing habitat in the Low Flow Channel. Unless the various potential habitat improvements are considered together in relation to a low flow reach flow regime, however, managing flow alone could create additional conflicts.

The main certain conflict with this measure is the demand for streamflow that potentially could be used for other Resource Actions, for power generation, or for water supply.

Uncertainties:
The major uncertainty with this measure is defining the level of streamflow that will provide the most benefits to anadromous salmonids. That uncertainty is increased because of the variety of other habitat improvement measures that might be implemented in the low flow channel. Various simulations using PHABSIM and Fluvial-12 could help better define the most beneficial streamflow scenarios, however, actual field tests (experimental releases) may also be valuable to identify any concerns caused by flow increases (excess erosion, etc.)

Cost Estimate:
Costs for this measure can be quantified in terms of reduced power generation. These costs would need to be further developed with the Project modeling group.

Recommendations:
The preliminary analysis of SP F16 showed Chinook spawning habitat in the low flow reach between the Fish Barrier Dam and Thermalito Afterbay Outlet is maximized between 700 and 725 cfs. In addition, the F16 study report indicated that the steelhead spawning habitat index in the LFC has a very low magnitude and has no distinct optimum over a range of flow between 150 and 1,000 cfs. The rearing habitat indexes for fry and juvenile Chinook were indeterminant for discharge, depending on how areas having no cover were treated in the models. The indeterminant relationships for rearing support an interpretation that flow volume in the LFC is less important as a management action than other possible alternatives, such as maintaining water quality or increasing habitat quality or complexity. Based on the preliminary information discussed in SP F16, it appears that flow management should not be considered apart from other measures that would be designed to improve spawning habitat for anadromous salmonids in the Low Flow Channel. Instead, a comprehensive approach to habitat management and improvement is recommended. Tools such as PHABSIM and Fluvial-12 can be used to evaluate potential combinations of physical habitat improvements and flows.

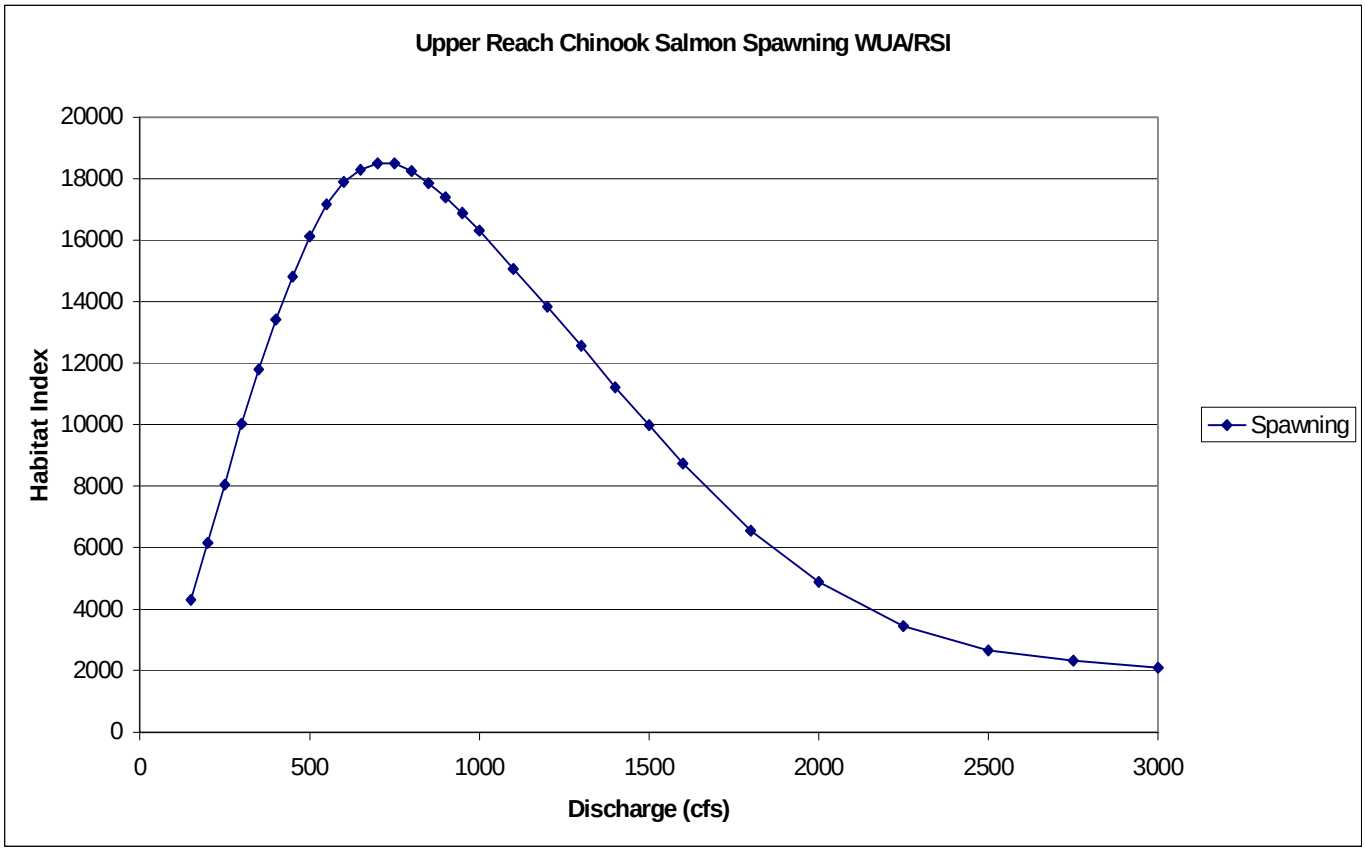

Figure 1. Upper (Low Flow) Reach Chinook Salmon Spawning WUA/RSI

References:

Cavallo, B., R. Kurth, J. Kindopp, A. Seeholtz, and M. Perrone. 2003. Distribution and habitat use of steelhead and other fishes in the lower Feather River, 1999-2001. Interim report prepared by California Department of Water Resources. January 22, 2003.

DWR (California Department of Water Resources). 1994. Results of lower Feather River instream flow study. Report prepared for State Water Resources Control Board by Department of Water Resources in cooperation with Department of Fish and Game. Draft dated January 26, 1994.

TRPA (Thomas R. Payne & Associates). 2003. SP-F16 Evaluation of Project Effects on Instream Flows and Fish Habitat Draft Phase 2 Draft Final Report.